



# Nighttime Weight Change Monitor

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Client - Dr. Timothy Juergens

## Abstract

It has been proposed to design a weighing device that can measure weight change of a patient in a hospital bed over the course of night. The device would likely have to support a hospital bed sitting on four legs. The more accurate the device the more useful it will be. The device will allow our client to further his research on the correlation between sleep stages and consequent weight changes.

## Problem Statement

For most people, weight fluctuates throughout the day and night. As a result one can lose as much as 700 grams over the course of the night, even if they do not eat or go to the bathroom. Much of this is related to metabolism, as well as water loss. Our client believes that weight change may occur at varying rates during different stages of sleep. This pattern of weight loss may have an effect on changes in weight on a larger time scale. We would like to be able to measure this weight change accurately on people who are in hospital beds.

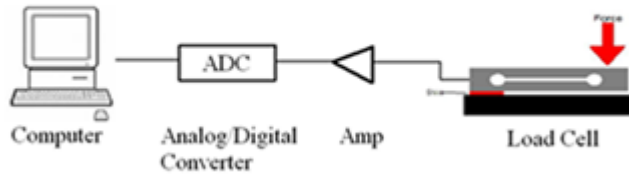
## Motivation

- A recent study at a University in Japan showed a connection between erratic weight fluctuations over the course of the night and weight gain over a longer course of time.

- A study at Yale University has shown a connection between insomnia and obesity. Patients who suffered from insomnia or other sleep ailments were more apt to become obese.

- Dr. Juergens would like to perform a similar study testing for a possible connection between weight change during individual stages of sleep and the overall weight change of the patient.

## Final Design



## Client Requirements

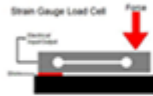
- As accurate as possible (Ideally 0.05 lbs)
- No discomfort to patient
- Quick (1-2 hours) transfer time between beds
- Capable of handling 300 lb patient
- Price range \$300 - \$500
- Provide digital readout of data to computer software, preferably Microsoft Excel

## Cost Analysis

Component	Supplier	Cost
Load Cell	Amesbury Systems	\$2.00
ADC	SparkFun	\$2.00
OpAmp, Buffer	Adafruit	\$4.00
5V Battery	Agilent	\$4.00
Amplifier Components	Radio Shack	\$3.00
	<b>Total</b>	<b>\$19.00</b>

## Design Components

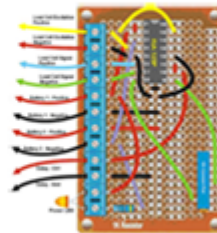
**Load Cell**  
Load cell converts mechanical distortion into electrical signal



**Analog/Digital Converter**  
Converts analog signal output by load cell into discrete digital values which can be read and manipulated using a computer



**Amplifier**  
Increases the weak signal output by the load cell



**Test Stand**  
Required for proper operation of the load cell

## Future Work

- Purchase four load cells with adequate maximum load and accuracy
- Combine the four individual load cells to get one reading
- Build amplifier circuit for each load cell
- Calibrate and test load cells
- Test the device in hospital environment

## References

Tanaka M, Itoh K, Awa S, Imai K, Masuda T, Koga R, Ito H, Konami Y, Kinoshita N, Sakata T. "Irregular patterns in the daily weight trend of night-predominant body weight gain". *Experimental Biology and Medicine*. 233:945-949. 2008.  
Hosoth, Tamas. "Obesity and Insomnia Linked by Excitability of Brain Cells." *Cell Metabolism*. Vol. 1, Issue 4 (April 2005).  
Yawn, Jimmy. "INA 125 Amplifier for Test Ruckel Stand." <http://www.jameco.com/electronics/stand/ina125.html>. 20 October 2008.